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Insect Prevention in Farm Stored Grain

Cooperative Extension South Dakota State University

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insect prevention
in farm stored grain

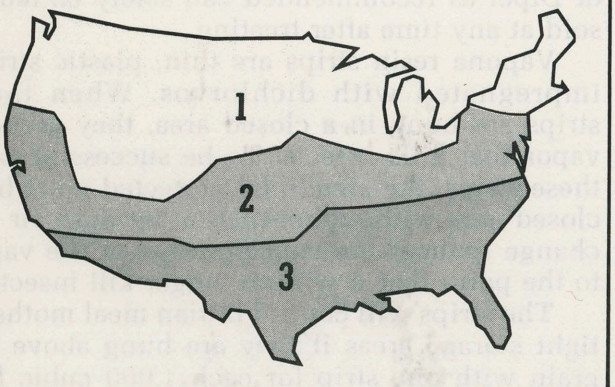
Insects frequently cause as much damage to grain in storage as they do to grain in the field. They do this in two ways. First, direct feeding damage reduces weight, nutritional value, germination, and lowers market value. Second, deterioration and contamination caused by the presence of insects results in the downgrading of grain containing foreign matter. This may be from insects, insect parts, odors, molds, or heat damage, and also reduces market value.

According to recent studies, there is reason for concern. Each year, as much as 40% of all grains produced in the U.S. are lost between the field and the table, and most of that while the grain is in storage. Today's grain storage containers represent one of the greatest single food concentrations man has ever devised for himself, and his most relentless enemies—rodents, insects, and spoilage.

The map in Figure 1 illustrates the degree to which farm stored grain in the U.S. is subject to attack. In the northern half of the country, little if any damage occurs to well managed grain on the farm during the first season of storage. However, in the central area, damage may easily occur during this period. Farther south, insects are a very serious problem throughout the storage period. If you are keeping grain anywhere in the U.S. for more than 12 months, you can expect to have problems with pests and other storage damage.

By taking proper precautions during three stages of the harvest and storage period, the risk of infestation and loss can be greatly reduced: first, clean all bins and harvesting and handling equipment; second, store only clean, dry grain, and treat the grain with an approved grain protectant; and third, inspect your grain regularly throughout the storage period.

Figure 1.



1 Clean bins & equipment

While late summer's long, hot afternoon sun is preparing your crops for the approaching harvest, there is much you can do to reduce losses from insect damage and spoilage that may occur in storage.

Before any harvesting begins, thoroughly clean combines and other harvesting equipment of any old grain that might be left in the machine from last year's harvest. This grain could contain insects that would start a new infestation in the newly harvested grain. Also clean grain wagons, trucks, augers, driers, and other handling equipment. Then clean the bins, both inside and out. Grain spilled around loading and unloading areas will serve as a source of rodent and insect infestation for your new grain. Junk piles, weeds and tall grasses are also sources of infestation and should be removed from the bin area.

Next, clean inside the bin, and *never put new grain on top of old grain.* Use brooms, hoes, shovels and vacuum cleaners to clean out all of the old grain, cracked kernels, and grain debris. Clean walls, ceilings, ledges, sills, and floors. Clean behind partitions, between walls, and clean out cracks and crevices. Remove and burn all of these sweepings and other debris. Grain dust and cracked grain under false floors pro-

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vide an ideal growing area for flour beetles, dermestids, and Indian meal moth larvae. So remove false floors and aeration ducts for a thorough cleaning. And never store grain near feed rooms, stables, or animal feeders. These areas often harbor insects which can infest the stored grain.

After the bin is thoroughly cleaned, spray all inside and outside surfaces with malathion or methoxychlor about two weeks before storing grain. Be sure to spray removable doors, behind false partitions, under false floors, etc. Before putting grain into treated bins, sweep up and dispose of all dead insects on the bin floor to avoid contamination of clean grain.

Use a compressed air garden sprayer or similar equipment and spray surfaces to the point of runoff. One gallon (3.79 l) of spray will cover approximately 750 to 1,000 square feet (70-93 m^2) of surface. Exact coverage depends on whether it is a wood, metal, or concrete wall. The porous surface of wood will require more spray than will a metal wall.

Caution—Premium grade malathion and methoxychlor are registered for use in storage bins for barley, corn, oats, rye, sorghum, and wheat, but not soybeans.

2 Store clean, dry grain

Grain containing weed seeds, cracked kernels, and other dockage will tend to become infested with insects sooner than will sound, clean grain. Moisture, temperature, and grain dust or dockage interact to provide conditions favorable for insect reproduction and survival. Presence of grain dust or dockage permits some of the grain beetles to survive and reproduce at extremely low temperatures. Adjust the combine so as to produce a minimum of cracked kernels while still removing the maximum amount of dockage. If grain is to be stored for more than one year, it is recommended that all grain be screened before being placed in the bin.

Don't store grain with high moisture content. Use your moisture meter or take a sample to your elevator and have the moisture content checked. Safe moisture content of grain depends on length of storage and grain temperature.

Insects may obtain moisture from the air, grain, or metabolic water from breakdown of starches. Their activity also produces heat which can lead to further reduction in grain quality by grain respiration and mold growth.

Grain Quality Maintenance

Dry, insect-free small grain or shelled corn can be protected from most insect damage by using malathion as a grain protectant. Apply insecticide to the grain stream as it comes out of the combine if grain is dry, or as it is being elevated into the bin. Forcing heated air through grain treated with malathion will reduce the effectiveness of the malathion. When using heat, dry the grain first, then apply the malathion after the grain has cooled.

After binning is completed, level the grain. If the grain has to be fumigated later, the low spots will collect most of the fumigant, while the high spots will go untreated. Leave at least 6 inches (15 cm) of space between the top of the leveled grain surface and the top of the bin wall so that the fumigant will not "spill over" the sides.

Topdress the bin by treating all the leveled surface grain with recommended grain protectants. The "top-dressing" acts as a barrier, preventing insects from entering the grain mass and from feeding on the surface of the grain. Each time the surface grain is disturbed, such as when probing for moisture or insect samples, the barrier is broken. Retreat disturbed areas with grain protectant.

If Indian meal moths have been a problem in the bin in the past, it is strongly suggested that a "topdress" of Dipel® be used, since these insects are resistant to malathion. Dipel does not control weevils and beetles; therefore, malathion is still recommended as a protectant for the bulk of the grain.

Caution—Premium grade malathion is registered for use on stored barley, corn, oats, rye, sorghum, and wheat, but not on stored soybeans. Dipel is registered for use on stored grains and soybeans and is exempt from tolerance restrictions. Grain treated with malathion or Dipel as recommended can safely be fed or sold at any time after treating.

Vapona resin strips are thin, plastic strips, impregnated with dichlorvos. When these strips are hung in a closed area, they give off vapor that kills insects. To be successful with these strips, the area to be protected must be a closed area without ventilation because air exchange reduces the concentration of the vapor to the point that it will no longer kill insects.

The strips will control Indian meal moths in tight storage areas if they are hung above the grain with one strip for each 1,000 cubic feet

(28.3[3]) of air space over the grain. The strips must be hung before moths begin to emerge in the spring. Strips will last up to four months. If strips are used, check grain once each month for a buildup of insects. Replace strips if live pests are seen.

If grain temperature and temperature of insects in the grain is reduced to 60°C or lower, most insects stop feeding and reproducing. Cool winter temperatures can be effectively used to cool the grain mass in a bin, making the grain unfavorable for insect development and thus reducing damage to the grain. Use aeration fans to reduce grain temperature to 40°F (4.4°C). Grain cooled to 40°F (4.4°C) should not become warm enough for insect damage until the following summer. Aeration system management is necessary to maintain uniform temperature throughout the grain during seasonal temperature variations and to minimize the potential for convection currents and resulting moisture deposition.

As grain temperature increases, insects are able to reproduce in grain of lower moisture content. Stored grain insects require more time at low temperatures and less time at high temperatures to complete their life cycle. For every species of stored grain insects there is a minimum constant temperature threshold below which development ceases. Most species of stored grain insects do not multiply fast enough to become a pest until the temperature is 5 to 9°F (2.8-5°C) above the minimum temperature requirement. There is also a 5 to 7° F (2.8-3.9°C) temperature range at which the rate of population increase is greatest. The minimum temperature range varies from 50 to 79°F (10-26°C) with optimum temperature range of 60-99°F (15.6-37.2°C).

Death of insects at low temperature can be due to freezing, starvation, or old age. Some store grain insects are able to withstand temperatures below freezing for a few days.

3 Inspect regularly

Examine grain regularly to detect early infestations of insects. If an infestation is detected early, insects can be controlled before they have caused extensive damage. There are minimum acceptable levels of damage and contamination.

Once a week, check the grain for heating and off odors. Use a sharp-pointed stick or rod to determine if hard, compacted areas are developing. Probe samples of the grain do not have to be taken each week. In the winter, when the grain is cooler, take probe samples every 4 to 6 weeks. During warmer months, take probe samples every 1 to 2 weeks. Use a grain probe which may be purchased or borrowed from your local grain buyer.

During cold weather, insects will congregate near the center of the grain mass where it is warmer, so sample the center of the grain mass thoroughly during the winter. Utilize the aeration system to minimize temperature variations within the bin. During warm weather, infestations usually begin near the surface, so pay special attention to that area during the summer.

Following a systematic procedure for making probes, empty each sample into a grain sampling tray or section of eaves trough long enough to accommodate the grain probe. Sift the samples through a 10 to 12 mesh per inch (2.5 cm) screen and examine for insects.

When first entering the bin, insert the probe horizontally 2 to 4 inches (5-10 cm) under the grain surface in the center of the bin before the grain surface is disturbed. Collect the sample and examine for insects. Take additional surface samples around the sides of the bin. Then probe from the top to the bottom of the grain mass. Extensions may have to be attached to the probe so that it can penetrate to the bin floor.

In round bins, start the deep probes at the center, then probe around the wall. Insert the probe about one foot (30 cm) from the outer wall. Make surface and deep probes at the north, west, south, and east sides of the bin. Examine each sample for insects. In extremely large bins, samples may have to be taken at more locations, no farther apart then every 20 feet (6 m). Take surface probes first, then probe from the top to the bottom, examining each sample for insects. Always retreat surface with topdressing of grain protectant after disturbing the grain.

If you find considerable damage and/or insects in the probe samples and cannot identify the insects, you could show them to your county extension agent or elevator manager for positive identification. If one granary weevil, one rice weevil, or one lesser grain borer, or as many as five insects of other species such as flour beetles and saw-toothed grain beetles are found per quart (0.9 l) sample of grain, fumigation of the grain is necessary to prevent further insect damage. Grain temperature should be above 65° F (18.3° C) for the fumigant to be effective.

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